Study of Desert Aerosols in the Mediterranean Area - An Israeli Hitchhiker Experiment (MEIDEX)

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MEIDEX- MEditerranean Israeli Dust EXperiment

- An experiment on board the shuttle within the Hitchhiker program.
- Under an agreement between NASA and the ISA (Israeli Space Agency).

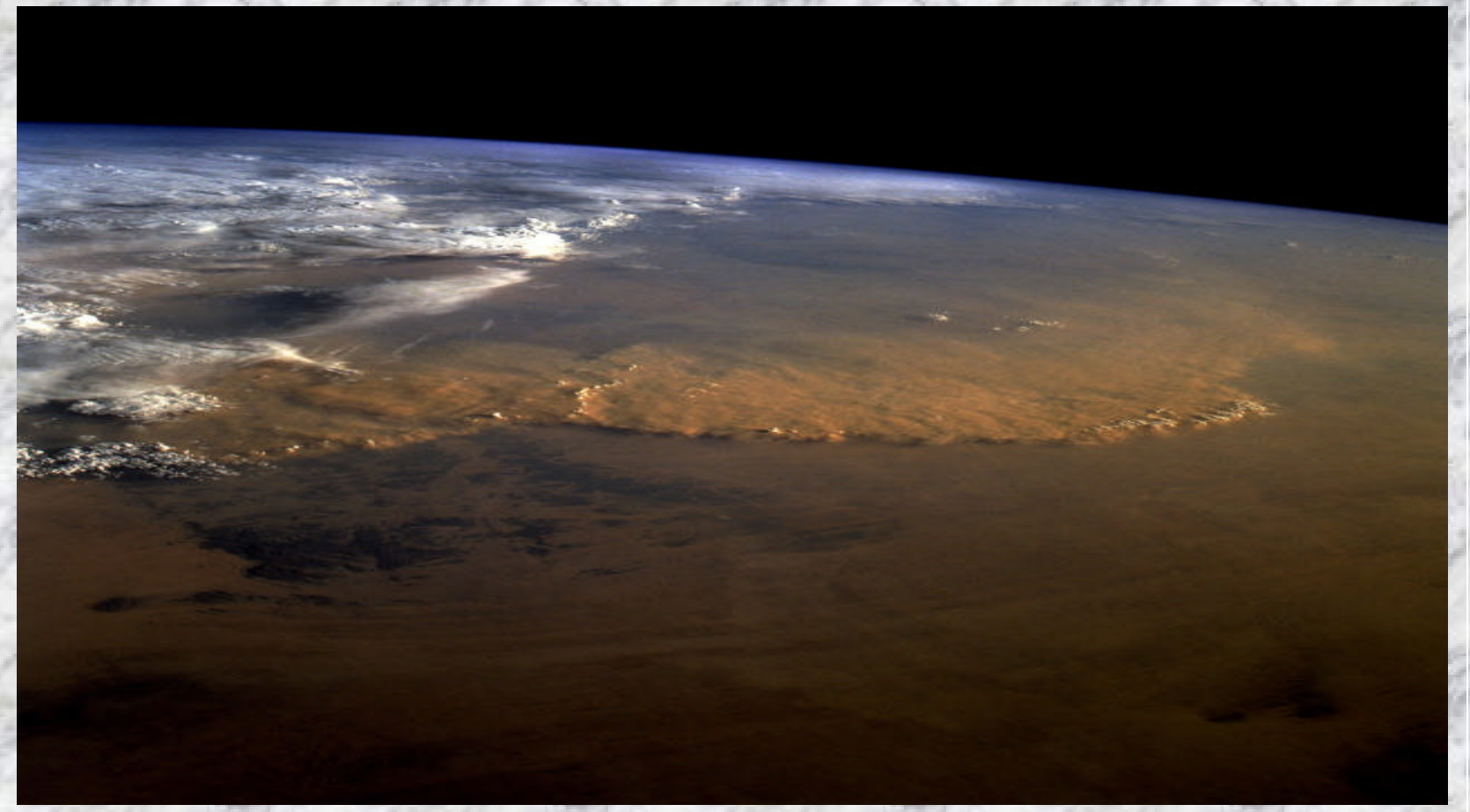
The Israeli Science Team

The team consists of scientists from different disciplines -

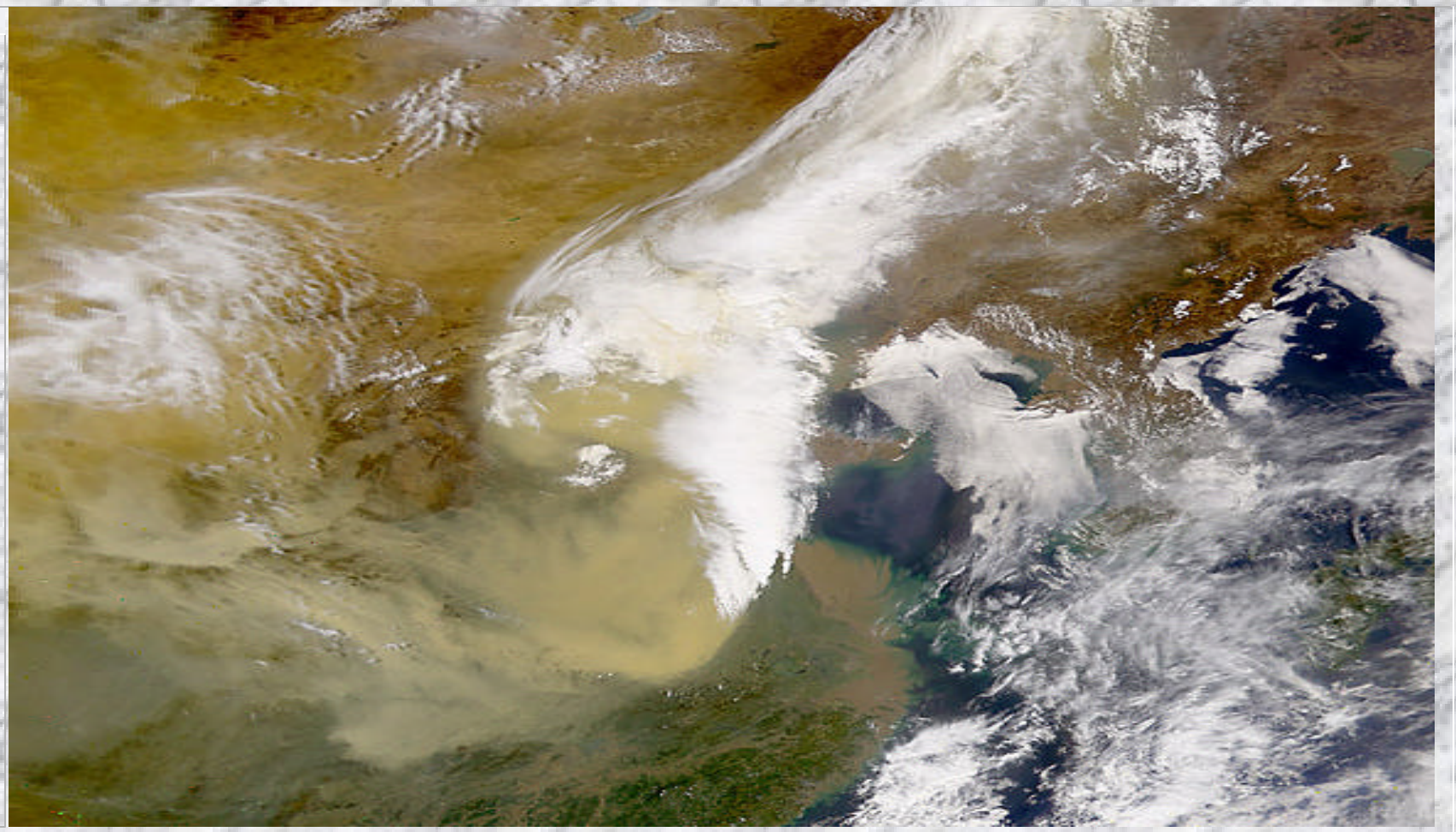
- Remote sensing of the atmosphere,
- Radiation transfer,
- Aerosol measurements and analysis,
- Modeling of atmospheric processes in many scales,
- Instrumentation for Remote Sensing and for airborne aerosol sampling.

Dust Storm in the Dead Sea Valley

Dust Storm In The Sahara



Dust From The Asian Continent



Why Study Dust Storms

- Dust particles are a major component of natural aerosols in the atmosphere.
- Their influence on climate change is not fully understood. They may help cool or warm the atmosphere depending on their size and chemical composition.
- They affect clouds and precipitation, especially in areas located downwind from deserts e.g. the eastern Mediterranean.

The Effects of Dust Particles

- They affect the incoming solar radiation - DIRECT EFFECT.
- They affect the formation and composition of clouds - INDIRECT EFFECT.
- They affect rainfall amounts and intensities (dust + sulfate + organic matter).

The Effects of Dust Particles (Continue)

- They reduce the contrast in remote sensing measurements.
- They affect biological activity in the Ocean

Other Existing Experiments for Measuring Dust

- TOMS - uses UV wavelength -- mostly sensitive to dust particles at higher altitudes.
- MODIS - is scheduled to be launched in October 99.

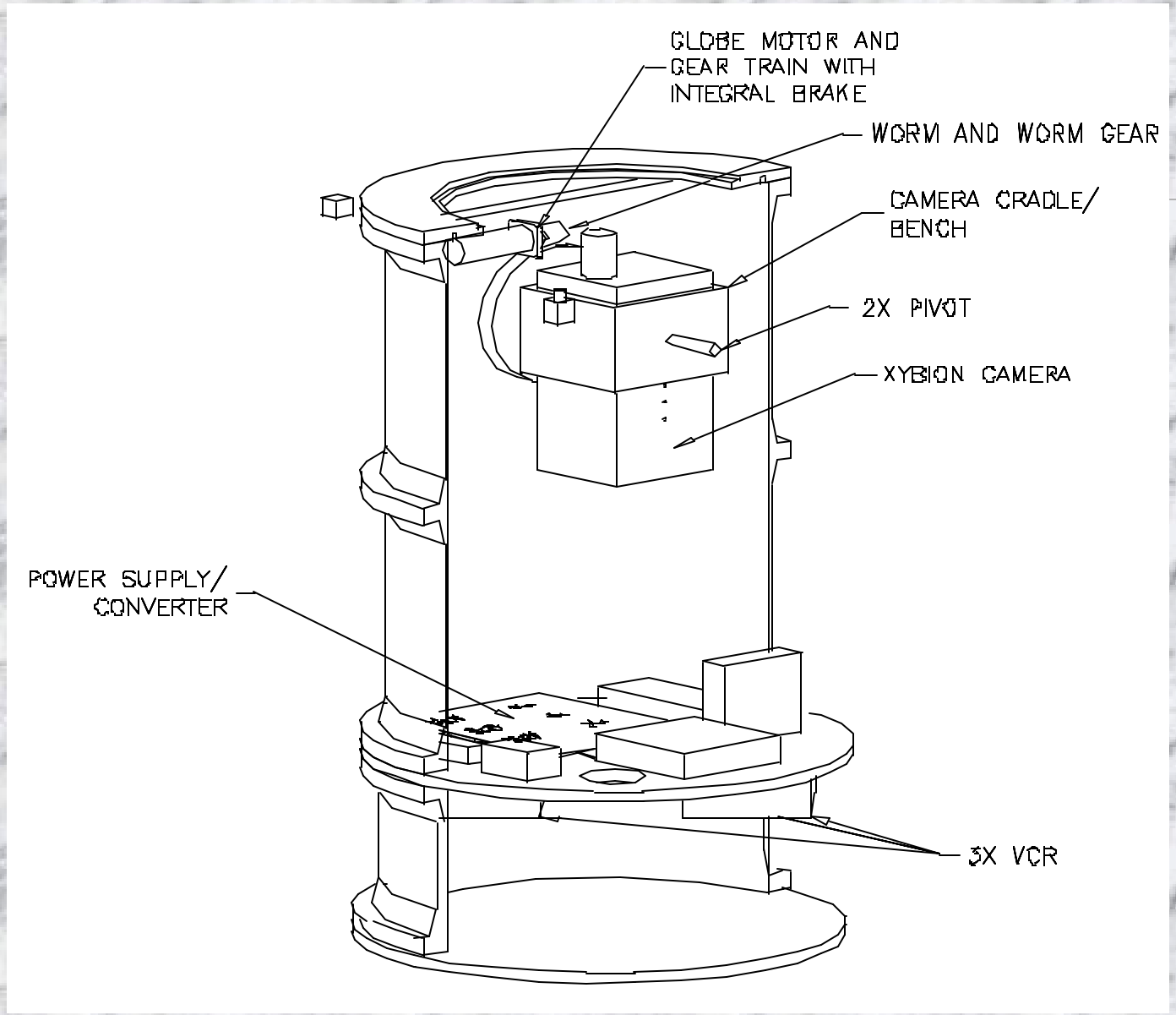
The Aims of MEIDEX

- Remote sensing of desert aerosols from the shuttle: The camera simultaneously simulates MODIS and TOMS (in some wavelengths).
- Absolute calibration by ground and airborne measurements
- Real-Time selection of targets using meteorological models and ground observations.

Spaceborne Camera

Multi spectral CCD camera by
Xybion Electronics

(340 +/- 0.8 nm, 380 +/- 0.8 nm, 470 +/- 6 nm,
555+/- 6 nm, 660 +/- 10 nm, 860 +/- 8 nm).



PAYLOAD GENERAL ARRANGEMENT

Location of Experiment

- Preferred regions
  - Major desert aerosol regions
    - Mediterranean
    - Tropical Atlantic
  - Alternate Regions
    - Saudi Arabia to India
    - Eastern Asia
    - Western Pacific

Preferred Seasons

- The best season is Spring
  - March to May
- The second best season is the Fall
  - October to December (we are scheduled to fly during Dec. 2000.

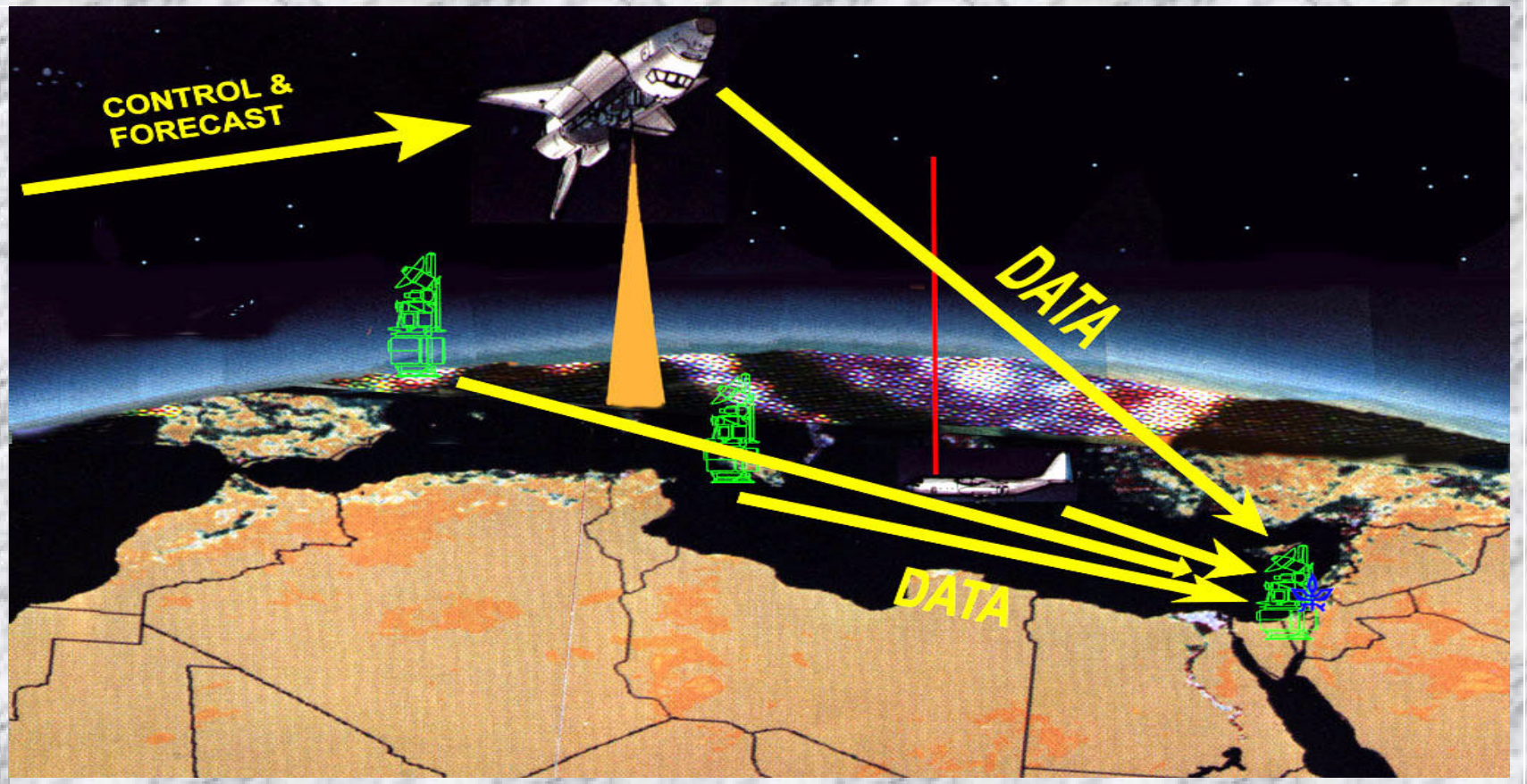
Orbit inclinations

The orbiter will be flying at an inclination angle of 39^0 . At this inclination the shuttle will view the Mediterranean Sea at Nadir.

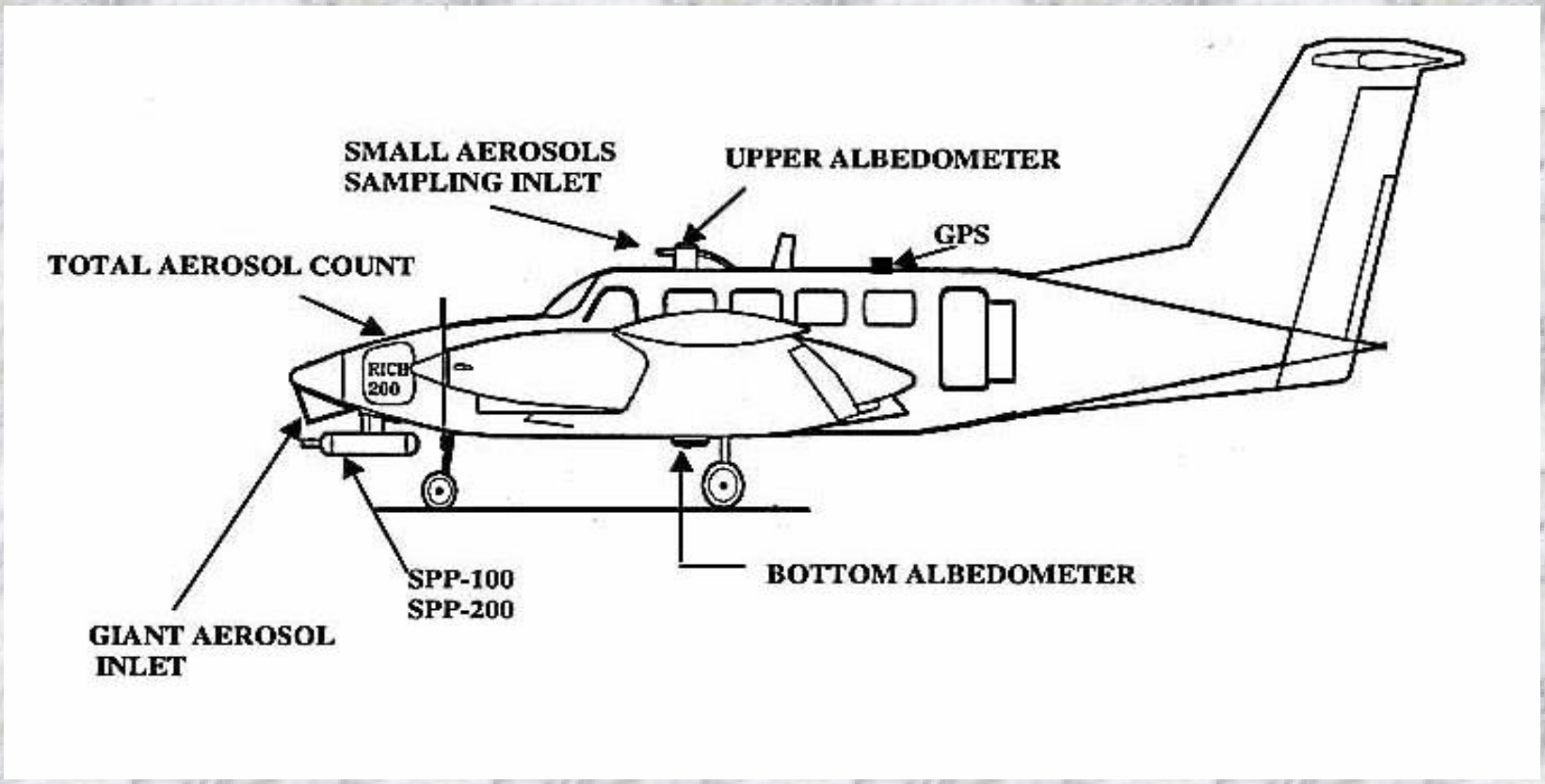
Mode of Operation

- Collection of data by multiple instruments during the course of the experiment.
- Selection of target by forecast/observation.
- Spectral scanning of dust from the shuttle.
- Ground based and airborne measurements.
- Forecast of dust plume trajectory
- Planning of activity in the next orbit.

The MEIDEX Data Acquisition Scheme.



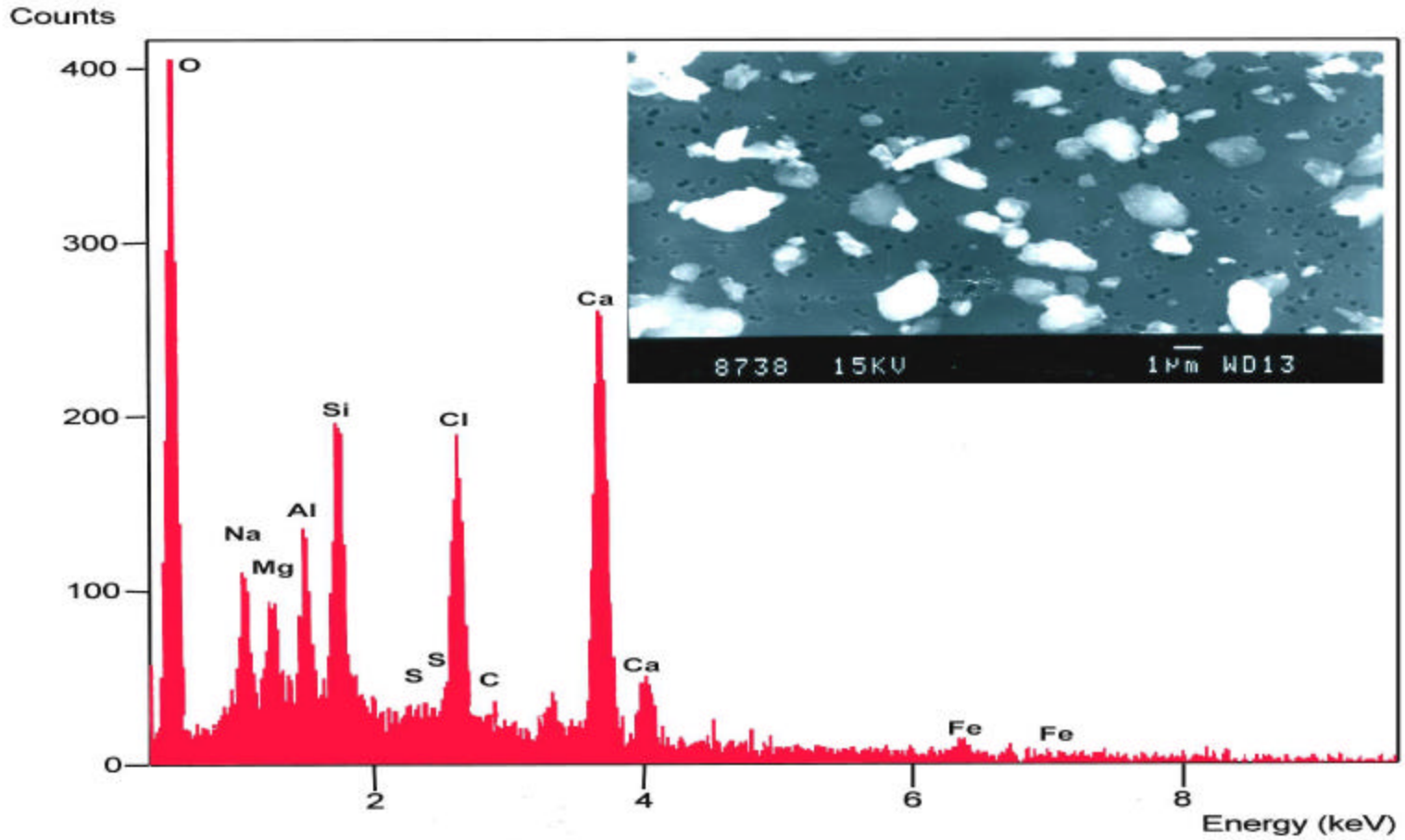
Research Airplane (Cheyenne III)



Airborne Instruments (Cheyenne III)

- Fuselage mounted Optical spectrometers --
  - **SPP 200 by DMT (0.1 to 3 microns).**
  - **SPP 100 by DMT (0.3 to 47 microns).**
- Isokinetic sampling of aerosol particles on filters and on EM grids.
- Two albedometers
- GPS

Analysis of Composition of Mineral Dust Particles



Post Experiment Applications

- Unified data base on dust aerosols from MODIS, TOMS etc.
- Definition of sources and sinks of desert dust.
- Simulation of transport of dust in models.
- Simulation of interactions of dust with clouds and precipitation.